

Please amend claims 1 and 2 as follows:

Claim 1, last three lines, delete ", whereby said hydrogen atom reacts with said catalyst and said cathode in said vessel, thereby producing a hydride ion having a binding energy greater than 0.8 eV".

Claim 2, last four lines, delete "; whereby said increased binding energy hydrogen atom reacts at said cathode with electrons supplied by said reductant, thereby producing a hydride ion having a binding energy greater than 0.8 eV".

Please add new claims 15-55 as follows:

~~15~~ 15. A fuel cell comprising:

a vessel;  
a source of hydrino atoms associated with said vessel; and  
a cathode in said vessel.

~~16~~ 16. A fuel cell comprising:

a vessel;  
a source of hydrogen atoms associated with said vessel;  
a cathode in said vessel; and  
a source of catalyst for forming hydrino atoms from said hydrogen atoms,  
said source of catalyst comprising a salt of rubidium.

~~15~~ 17. A fuel cell according to claim ~~16~~ 14, wherein said salt of rubidium is selected from the group consisting of RbOH, Rb<sub>2</sub>SO<sub>4</sub>, Rb<sub>2</sub>CO<sub>3</sub>, and Rb<sub>3</sub>PO<sub>4</sub>.

~~18~~ 18. A fuel cell comprising:

a vessel;

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~~a source of hydrogen atoms associated with said vessel;  
a cathode in said vessel; and  
a source of catalyst for forming hydrino atoms from said hydrogen atoms,  
said source of catalyst comprising a salt of potassium.~~

*17* 18. A fuel cell according to claim <sup>16</sup> 18, wherein said salt of potassium is selected from the group consisting of KOH, K<sub>2</sub>SO<sub>4</sub>, K<sub>2</sub>CO<sub>3</sub> and K<sub>3</sub>PO<sub>4</sub>.

*sub 04* 20. A fuel cell comprising:

~~a vessel;  
a source of hydrogen atoms associated with said vessel;  
a cathode in said vessel; and  
a source of catalyst for forming hydrino atoms from said hydrogen atoms,  
said source of catalyst comprising a salt of titanium.~~

*19* 21. A fuel cell according to claim <sup>18</sup> 20, wherein said salt of titanium is selected from the group consisting of TiF<sub>2</sub>, TiCl<sub>2</sub>, TiBr<sub>2</sub>, TiI<sub>2</sub> and TiS.

*sub 05* 22. A fuel cell comprising:

~~a vessel;  
a source of hydrogen atoms associated with said vessel;  
a cathode in said vessel; and  
a source of catalyst for forming hydrino atoms from said hydrogen atoms,  
said source of catalyst comprising at least one selected from the group consisting  
of (Al<sup>2+</sup>), (Ar<sup>+</sup>), (Ti<sup>2+</sup>), (As<sup>2+</sup>), (Rb<sup>+</sup>), (Mo<sup>2+</sup>), (Ru<sup>2+</sup>), (In<sup>2+</sup>), and (Te<sup>2+</sup>).~~

23. A fuel cell comprising:

~~a vessel;  
a source of hydrogen atoms associated with said vessel;~~

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- a cathode in said vessel; and  
a source of catalyst for forming hydrino atoms from said hydrogen atoms,  
said catalyst being capable of providing a net enthalpy of reaction in the range of  
26.8 to 28.5 eV.
24. A fuel cell comprising:  
a vessel;  
a source of hydrogen atoms associated with said vessel;  
a cathode in said vessel; and  
a source of catalyst for forming hydrino atoms from said hydrogen atoms,  
said catalyst comprising at least one pair of ions selected from the group consisting  
of: (Sn<sup>4+</sup>, Si<sup>4+</sup>), (Pr<sup>3+</sup>, Ca<sup>2+</sup>), (Sr<sup>2+</sup>, Cr<sup>2+</sup>), (Cr<sup>3+</sup>, Tb<sup>3+</sup>), (Sb<sup>3+</sup>, Co<sup>2+</sup>), (Bi<sup>3+</sup>, Ni<sup>2+</sup>), (Pd<sup>2+</sup>,  
In<sup>+</sup>), (La<sup>3+</sup>, Dy<sup>3+</sup>), (La<sup>3+</sup>, Ho<sup>3+</sup>), (K<sup>+</sup>, K<sup>+</sup>), (V<sup>3+</sup>, Pd<sup>2+</sup>), (Lu<sup>3+</sup>, Zn<sup>2+</sup>), (As<sup>3+</sup>, Ho<sup>3+</sup>), (Mo<sup>5+</sup>,  
Sn<sup>4+</sup>), (Sb<sup>3+</sup>, Cd<sup>2+</sup>), (Ag<sup>2+</sup>, Ag<sup>+</sup>), (La<sup>3+</sup>, Er<sup>3+</sup>), (V<sup>4+</sup>, B<sup>3+</sup>), (Fe<sup>3+</sup>, Ti<sup>3+</sup>), (Co<sup>2+</sup>, Ti<sup>+</sup>), (Bi<sup>3+</sup>,  
Zn<sup>2+</sup>), (As<sup>3+</sup>, Dy<sup>3+</sup>), (Ho<sup>3+</sup>, Mg<sup>2+</sup>), (K<sup>+</sup>, Rb<sup>+</sup>), (Cr<sup>3+</sup>, Pr<sup>3+</sup>), (Sr<sup>2+</sup>, Fe<sup>2+</sup>), (Ni<sup>2+</sup>, Cu<sup>+</sup>), (Li<sup>+</sup>,  
Pb<sup>2+</sup>), (Sr<sup>2+</sup>, Mo<sup>2+</sup>), (Y<sup>3+</sup>, Zr<sup>4+</sup>), (Cd<sup>2+</sup>, Ba<sup>2+</sup>), (Ho<sup>3+</sup>, Pb<sup>2+</sup>), (Eu<sup>3+</sup>, Mg<sup>2+</sup>), (Er<sup>3+</sup>, Mg<sup>2+</sup>),  
(Bi<sup>4+</sup>, Al<sup>3+</sup>), (Ca<sup>2+</sup>, Sm<sup>3+</sup>), (V<sup>3+</sup>, La<sup>3+</sup>), (Gd<sup>3+</sup>, Cr<sup>2+</sup>), (Mn<sup>2+</sup>, Ti<sup>+</sup>), (Yb<sup>3+</sup>, Fe<sup>2+</sup>), (Ni<sup>2+</sup>, Ag<sup>+</sup>),  
(Zn<sup>2+</sup>, Yb<sup>2+</sup>), (Se<sup>4+</sup>, Sn<sup>4+</sup>), (Sb<sup>3+</sup>, Bi<sup>2+</sup>), and (Eu<sup>3+</sup>, Pb<sup>2+</sup>).
25. A fuel cell comprising:  
a vessel;  
a source of hydrogen atoms associated with said vessel;  
a cathode in said vessel; and  
a source of catalyst for forming hydrino atoms from said hydrogen atoms,  
said catalyst comprising oxygen in combination with at least one atom selected from  
the group consisting of Cu, As, Pd, Te, Cs and Pt.
26. A fuel cell comprising:  
a vessel;

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a source of hydrogen atoms associated with said vessel;  
 a cathode in said vessel; and  
 a source of catalyst for forming hydrino atoms from said hydrogen atoms,  
 said catalyst comprising at least one pair selected from the group consisting of: (B,  
 $\text{Li}^+$ ), (S,  $\text{Li}^+$ ), (Br,  $\text{Li}^+$ ), ( $\text{Pm}^+$ ,  $\text{Li}^+$ ), ( $\text{Sm}^+$ ,  $\text{Li}^+$ ), ( $\text{Tb}^+$ ,  $\text{Li}^+$ ), ( $\text{Dy}^+$ ,  $\text{Li}^+$ ), ( $\text{Sb}^+$ ,  $\text{H}^+$ ) and ( $\text{Bi}^+$ ,  $\text{H}^+$ ).

## 27. A fuel cell comprising:

a vessel;  
 a source of hydrogen atoms associated with said vessel;  
 a cathode in said vessel; and  
 a source of catalyst for forming hydrino atoms from said hydrogen atoms,  
 said catalyst comprising at least one pair selected from the group consisting of:

|                    |                   |                   |
|--------------------|-------------------|-------------------|
| ( He 0+ , Co 3+ ); | (O 1+ , Nd 4+ );  | (Al 2+ , Cl 5+ ); |
| ( He 0+ , Ga 3+ ); | (O 1+ , Tb 4+ );  | (Al 4+ , Mn 8+ ); |
| ( Li 0+ , Ni 3+ ); | (O 2+ , Ne 3+ );  | (Si 1+ , Mg 2+ ); |
| ( Li 0+ , Xe 3+ ); | (O 3+ , Sb 6+ );  | (Si 1+ , V 2+ );  |
| ( Li 0+ , Hg 3+ ); | (O 4+ , Fe 7+ );  | (Si 1+ , Tc 2+ ); |
| ( Li 1+ , Na 4+ ); | (F 0+ , Al 2+ );  | (Si 1+ , Sn 2+ ); |
| ( Li 1+ , Y 6+ );  | (F 0+ , Si 2+ );  | (Si 1+ , Hf 2+ ); |
| ( Be 1+ , Bi 6+ ); | (F 0+ , Fe 2+ );  | (Si 1+ , Pb 2+ ); |
| ( Be 2+ , Al 6+ ); | (F 0+ , Co 2+ );  | (Si 2+ , Co 3+ ); |
| ( B 1+ , C 2+ );   | (F 0+ , Ru 2+ );  | (Si 2+ , Ga 3+ ); |
| ( B 1+ , K 2+ );   | (F 0+ , In 2+ );  | (Si 2+ , Ge 3+ ); |
| ( B 1+ , Ho 3+ );  | (F 0+ , Sb 2+ );  | (Si 2+ , Tl 3+ ); |
| ( B 1+ , Er 3+ );  | (F 0+ , Br 2+ );  | (Si 3+ , Ni 6+ ); |
| ( B 1+ , Tm 3+ );  | (F 1+ , Sb 4+ );  | (Si 3+ , Rb 7+ ); |
| ( B 1+ , Lu 3+ );  | (F 3+ , Fe 6+ );  | (Si 4+ , Al 6+ ); |
| ( C 1+ , N 2+ );   | (Ne 0+ , Sm 3+ ); | (P 1+ , Mg 2+ );  |
| ( C 1+ , V 3+ );   | (Ne 0+ , Dy 3+ ); | (P 1+ , Tc 2+ );  |
| ( C 1+ , Tc 3+ );  | (Ne 0+ , Ho 3+ ); | (P 1+ , Sn 2+ );  |
| ( C 1+ , Ru 3+ );  | (Ne 0+ , Er 3+ ); | (P 1+ , Hf 2+ );  |
| ( C 1+ , Sn 3+ );  | (Ne 0+ , Lu 3+ ); | (P 1+ , Pb 2+ );  |
| ( C 2+ , Mn 4+ );  | (Ne 1+ , N 3+ );  | (P 2+ , Ni 3+ );  |
| ( C 2+ , Co 4+ );  | (Ne 1+ , K 3+ );  | (P 2+ , Cd 3+ );  |
| ( N 0+ , Sr 2+ );  | (Ne 1+ , V 4+ );  | (P 2+ , Xe 3+ );  |
| ( N 0+ , La 2+ );  | (Ne 2+ , O 4+ );  | (P 3+ , Nb 5+ );  |
| ( N 0+ , Ce 2+ );  | (Na 0+ , Al 2+ ); | (P 5+ , C 5+ );   |
| ( N 0+ , Pr 2+ );  | (Na 0+ , Si 2+ ); | (S 1+ , P 2+ );   |
| ( N 0+ , Nd 2+ );  | (Na 0+ , Fe 2+ ); | (S 1+ , Se 2+ );  |
| ( N 0+ , Pm 2+ );  | (Na 0+ , Co 2+ ); | (S 1+ , La 3+ );  |

|                    |                   |                   |
|--------------------|-------------------|-------------------|
| ( N 0+ , Sm 2+ );  | (Na 0+ , Ru 2+ ); | (S 1+ , Ce 3+ );  |
| ( N 0+ , Eu 2+ );  | (Na 0+ , In 2+ ); | (S 1+ , Au 2+ );  |
| ( N 1+ , O 2+ );   | (Na 0+ , Sb 2+ ); | (S 2+ , Sr 3+ );  |
| ( N 1+ , Si 3+ );  | (Na 0+ , Bi 2+ ); | (S 2+ , Cd 3+ );  |
| ( N 1+ , P 3+ );   | (Na 2+ , Ti 5+ ); | (S 3+ , Cu 4+ );  |
| ( N 1+ , Mn 3+ );  | (Na 2+ , Kr 6+ ); | (S 3+ , Rb 4+ );  |
| ( N 1+ , Rh 3+ );  | (Na 3+ , Y 7+ );  | (S 4+ , O 4+ );   |
| ( N 2+ , F 3+ );   | (Mg 1+ , Rb 3+ ); | (Cl 1+ , C 2+ );  |
| ( N 3+ , Br 6+ );  | (Mg 1+ , Eu 4+ ); | (Cl 1+ , K 2+ );  |
| ( O 0+ , Ti 2+ );  | (Mg 3+ , Ne 5+ ); | (Cl 1+ , Zr 3+ ); |
| ( O 0+ , V 2+ );   | (Mg 6+ , Cl 8+ ); | (Cl 1+ , Eu 3+ ); |
| ( O 0+ , Nb 2+ );  | (Al 1+ , Sc 2+ ); | (Cl 1+ , Tm 3+ ); |
| ( O 0+ , Hf 2+ );  | (Al 1+ , Zr 2+ ); | (Cl 2+ , Te 4+ ); |
| ( O 1+ , Ne 2+ );  | (Al 1+ , Lu 2+ ); | (Cl 2+ , Sm 4+ ); |
| ( O 1+ , Ca 3+ );  | (Al 2+ , S 5+ );  | (Cl 2+ , Gd 4+ ); |
| ( Cl 2+ , Ho 4+ ); | (Sc 4+ , N 5+ );  | (Mn 4+ , Ge 5+ ); |
| ( Cl 2+ , Er 4+ ); | (Ti 2+ , Ar 2+ ); | (Fe 1+ , Sc 2+ ); |
| ( Cl 3+ , Cl 4+ ); | (Ti 2+ , Mo 3+ ); | (Fe 1+ , Y 2+ );  |
| ( Cl 5+ , Ni 6+ ); | (Ti 4+ , O 5+ );  | (Fe 1+ , Yb 2+ ); |
| ( Cl 5+ , Cu 6+ ); | (Ti 4+ , Zn 6+ ); | (Fe 1+ , Lu 2+ ); |
| ( Cl 5+ , Rb 7+ ); | (Ti 4+ , As 6+ ); | (Fe 2+ , S 3+ );  |
| ( Ar 0+ , Ba 2+ ); | (V 1+ , Sr 2+ );  | (Fe 2+ , Cu 3+ ); |
| ( Ar 0+ , Ce 2+ ); | (V 1+ , La 2+ );  | (Fe 2+ , Zn 3+ ); |
| ( Ar 0+ , Pr 2+ ); | (V 1+ , Ce 2+ );  | (Fe 2+ , Br 3+ ); |
| ( Ar 0+ , Nd 2+ ); | (V 1+ , Pr 2+ );  | (Fe 2+ , Zr 4+ ); |
| ( Ar 0+ , Ra 2+ ); | (V 1+ , Nd 2+ );  | (Fe 2+ , Ce 4+ ); |
| ( Ar 1+ , Ti 3+ ); | (V 1+ , Pm 2+ );  | (Fe 5+ , Sr 7+ ); |
| ( Ar 2+ , C 3+ );  | (V 1+ , Sm 2+ );  | (Co 1+ , Mg 2+ ); |
| ( Ar 3+ , K 4+ );  | (V 1+ , Eu 2+ );  | (Co 1+ , Cr 2+ ); |
| ( Ar 3+ , Br 5+ ); | (V 2+ , Q 2+ );   | (Co 1+ , Mn 2+ ); |
| ( Ar 3+ , Mo 5+ ); | (V 3+ , Mn 4+ );  | (Co 1+ , Mo 2+ ); |
| ( Ar 4+ , Y 5+ );  | (V 3+ , Co 4+ );  | (Co 1+ , Tc 2+ ); |
| ( K 1+ , Si 3+ );  | (V 4+ , Ar 6+ );  | (Co 1+ , Pb 2+ ); |
| ( K 1+ , P 3+ );   | (V 4+ , Sc 5+ );  | (Co 2+ , Cu 3+ ); |
| ( K 1+ , Mn 3+ );  | (V 5+ , Mg 5+ );  | (Co 2+ , Zn 3+ ); |
| ( K 1+ , Ge 3+ );  | (V 6+ , Sc 8+ );  | (Co 2+ , Br 3+ ); |
| ( K 1+ , Rh 3+ );  | (V 6+ , Br 8+ );  | (Co 2+ , Zr 4+ ); |
| ( K 1+ , Tl 3+ );  | (Cr 1+ , Sc 2+ ); | (Co 2+ , Ag 3+ ); |
| ( K 2+ , He 2+ );  | (Cr 1+ , Ti 2+ ); | (Co 2+ , Ce 4+ ); |
| ( K 2+ , Si 4+ );  | (Cr 1+ , Zr 2+ ); | (Co 2+ , Hf 4+ ); |
| ( K 2+ , As 4+ );  | (Cr 1+ , Lu 2+ ); | (Co 4+ , Nb 6+ ); |
| ( K 3+ , P 5+ );   | (Cr 2+ , F 2+ );  | (Co 5+ , Sc 6+ ); |
| ( K 3+ , Zr 5+ );  | (Cr 2+ , Na 2+ ); | (Ni 1+ , Co 2+ ); |
| ( K 4+ , Rb 6+ );  | (Cr 2+ , Se 3+ ); | (Ni 1+ , Ni 2+ ); |
| ( K 5+ , Mg 4+ );  | (Cr 2+ , Pd 3+ ); | (Ni 1+ , Rh 2+ ); |
| ( K 5+ , Kr 7+ );  | (Cr 2+ , I 3+ );  | (Ni 1+ , Cd 2+ ); |
| ( K 6+ , Y 8+ );   | (Cr 2+ , Hg 3+ ); | (Ni 1+ , Sb 2+ ); |
| ( Ca 1+ , C 2+ );  | (Cr 3+ , O 3+ );  | (Ni 2+ , Ne 2+ ); |
| ( Ca 1+ , Sm 3+ ); | (Cr 3+ , Ni 4+ ); | (Ni 2+ , Ca 3+ ); |
| ( Ca 1+ , Dy 3+ ); | (Cr 4+ , O 4+ );  | (Ni 2+ , Nd 4+ ); |

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|                    |                   |                   |
|--------------------|-------------------|-------------------|
| ( Ca 1+ , Ho 3+ ); | (Cr 5+ , Ne 5+ ); | (Ni 2+ , Tb 4+ ); |
| ( Ca 1+ , Er 3+ ); | (Cr 5+ , Fe 7+ ); | (Ni 4+ , Rb 6+ ); |
| ( Ca 1+ , Tm 3+ ); | (Mn 1+ , V 2+ );  | (Ni 6+ , Ar 8+ ); |
| ( Ca 1+ , Lu 3+ ); | (Mn 1+ , Nb 2+ ); | (Cu 1+ , Ag 2+ ); |
| ( Ca 2+ , O 3+ );  | (Mn 1+ , Sn 2+ ); | (Cu 1+ , I 2+ );  |
| ( Ca 2+ , Ni 4+ ); | (Mn 1+ , Hf 2+ ); | (Cu 1+ , Cs 2+ ); |
| ( Ca 3+ , Mn 5+ ); | (Mn 2+ , Cu 3+ ); | (Cu 1+ , Au 2+ ); |
| ( Ca 3+ , Rb 5+ ); | (Mn 2+ , Zn 3+ ); | (Cu 1+ , Hg 2+ ); |
| ( Ca 4+ , Cl 6+ ); | (Mn 2+ , Br 3+ ); | (Cu 2+ , Sm 4+ ); |
| ( Ca 4+ , Ar 6+ ); | (Mn 2+ , Zr 4+ ); | (Cu 2+ , Gd 4+ ); |
| ( Ca 4+ , Sc 5+ ); | (Mn 2+ , Ce 4+ ); | (Cu 2+ , Dy 4+ ); |
| ( Ca 5+ , Y 7+ );  | (Mn 2+ , Hf 4+ ); | (Cu 3+ , K 4+ );  |
| ( Sc 2+ , Ti 4+ ); | (Mn 3+ , Mg 3+ ); | (Cu 3+ , Br 5+ ); |
| ( Sc 2+ , Bi 4+ ); | (Mn 3+ , Te 5+ ); | (Cu 3+ , Mo 5+ ); |
| ( Cu 4+ , Rb 6+ ); | (Se 1+ , Fe 2+ ); | (Sr 1+ , Ga 2+ ); |
| ( Cu 5+ , Mn 7+ ); | (Se 1+ , Co 2+ ); | (Sr 1+ , Te 2+ ); |
| ( Zn 1+ , P 2+ );  | (Se 1+ , Ge 2+ ); | (Sr 1+ , Pt 2+ ); |
| ( Zn 1+ , I 2+ );  | (Se 1+ , Ru 2+ ); | (Sr 1+ , Tl 2+ ); |
| ( Zn 1+ , La 3+ ); | (Se 1+ , In 2+ ); | (Sr 2+ , C 3+ );  |
| ( Zn 1+ , Au 2+ ); | (Se 1+ , Bi 2+ ); | (Sr 2+ , Mo 4+ ); |
| ( Zn 1+ , Hg 2+ ); | (Se 2+ , Te 3+ ); | (Sr 3+ , Ar 4+ ); |
| ( Zn 2+ , Ti 4+ ); | (Se 3+ , Br 4+ ); | (Sr 3+ , Sr 4+ ); |
| ( Zn 2+ , Sn 4+ ); | (Se 5+ , Y 7+ );  | (Sr 3+ , Sb 5+ ); |
| ( Zn 2+ , Bi 4+ ); | (Br 1+ , P 2+ );  | (Sr 3+ , Bi 5+ ); |
| ( Zn 3+ , As 5+ ); | (Br 1+ , I 2+ );  | (Sr 4+ , Ar 5+ ); |
| ( Zn 4+ , Sr 6+ ); | (Br 1+ , La 3+ ); | (Sr 4+ , Cu 5+ ); |
| ( Zn 5+ , Mn 7+ ); | (Br 1+ , Au 2+ ); | (Y 2+ , Sr 3+ );  |
| ( Zn 6+ , Mo 8+ ); | (Br 3+ , He 2+ ); | (Y 2+ , Cd 3+ );  |
| ( Ga 1+ , Cr 2+ ); | (Br 3+ , Si 4+ ); | (Y 3+ , Se 5+ );  |
| ( Ga 1+ , Mn 2+ ); | (Br 3+ , Ge 4+ ); | (Y 3+ , Pb 5+ );  |
| ( Ga 1+ , Fe 2+ ); | (Br 4+ , S 3+ );  | (Y 4+ , Ti 5+ );  |
| ( Ga 1+ , Ge 2+ ); | (Br 4+ , Cl 5+ ); | (Y 4+ , Zn 5+ );  |
| ( Ga 1+ , Mo 2+ ); | (Br 5+ , Sb 6+ ); | (Y 5+ , Co 6+ );  |
| ( Ga 1+ , Ru 2+ ); | (Br 6+ , Ar 8+ ); | (Y 6+ , K 7+ );   |
| ( Ga 1+ , Bi 2+ ); | (Kr 1+ , B 2+ );  | (Zr 2+ , P 2+ );  |
| ( Ga 2+ , Rb 3+ ); | (Kr 1+ , S 2+ );  | (Zr 2+ , Ag 2+ ); |
| ( Ga 2+ , Eu 4+ ); | (Kr 1+ , Br 2+ ); | (Zr 2+ , I 2+ );  |
| ( Ga 2+ , Tm 4+ ); | (Kr 1+ , Xe 2+ ); | (Zr 2+ , Cs 2+ ); |
| ( Ge 1+ , Mg 2+ ); | (Kr 1+ , Nd 3+ ); | (Zr 2+ , La 3+ ); |
| ( Ge 1+ , Mn 2+ ); | (Kr 1+ , Pm 3+ ); | (Zr 2+ , Au 2+ ); |
| ( Ge 1+ , Tc 2+ ); | (Kr 1+ , Tb 3+ ); | (Zr 2+ , Hg 2+ ); |
| ( Ge 1+ , Sn 2+ ); | (Kr 2+ , Kr 3+ ); | (Nb 2+ , C 2+ );  |
| ( Ge 1+ , Pb 2+ ); | (Kr 2+ , Tb 4+ ); | (Nb 2+ , K 2+ );  |
| ( Ge 2+ , F 2+ );  | (Kr 3+ , O 3+ );  | (Nb 2+ , Zr 3+ ); |
| ( Ge 2+ , Na 2+ ); | (Kr 3+ , Ni 4+ ); | (Nb 2+ , Eu 3+ ); |
| ( Ge 2+ , Se 3+ ); | (Kr 3+ , Kr 4+ ); | (Nb 2+ , Tm 3+ ); |
| ( Ge 2+ , Pd 3+ ); | (Kr 3+ , Nb 5+ ); | (Nb 2+ , Lu 3+ ); |
| ( Ge 2+ , I 3+ );  | (Kr 4+ , Zr 5+ ); | (Nb 3+ , Kr 3+ ); |
| ( Ge 3+ , V 5+ );  | (Kr 5+ , Sr 6+ ); | (Nb 3+ , Pr 4+ ); |
| ( Ge 3+ , Se 5+ ); | (Kr 6+ , Y 7+ );  | (Nb 3+ , Tb 4+ ); |

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|                    |                   |                   |
|--------------------|-------------------|-------------------|
| ( Ge 3+ , Pb 5+ ); | (Rb 1+ , Nb 3+ ); | (Nb 4+ , N 4+ );  |
| ( As 1+ , Sc 2+ ); | (Rb 2+ , Te 4+ ); | (Mo 1+ , Ba 2+ ); |
| ( As 1+ , Y 2+ );  | (Rb 2+ , Sm 4+ ); | (Mo 1+ , Pr 2+ ); |
| ( As 1+ , Zr 2+ ); | (Rb 2+ , Gd 4+ ); | (Mo 1+ , Nd 2+ ); |
| ( As 1+ , Lu 2+ ); | (Rb 2+ , Dy 4+ ); | (Mo 1+ , Ra 2+ ); |
| ( As 2+ , Co 3+ ); | (Rb 2+ , Ho 4+ ); | (Mo 2+ , Ru 3+ ); |
| ( As 2+ , Ga 3+ ); | (Rb 2+ , Er 4+ ); | (Mo 2+ , Sn 3+ ); |
| ( As 2+ , Ge 3+ ); | (Rb 3+ , Mg 3+ ); | (Mo 3+ , Cr 4+ ); |
| ( As 2+ , Tl 3+ ); | (Rb 3+ , Te 5+ ); | (Mo 3+ , Ge 4+ ); |
| ( As 3+ , Fe 4+ ); | (Rb 5+ , Rb 6+ ); | (Mo 4+ , Bi 5+ ); |
| ( As 4+ , Sb 6+ ); | (Rb 6+ , Te 7+ ); | (Mo 5+ , Mn 6+ ); |
| ( Se 1+ , Al 2+ ); | (Sr 1+ , Be 2+ ); | (Mo 6+ , O 6+ );  |
| ( Se 1+ , Si 2+ ); | (Sr 1+ , Zn 2+ ); | (Mo 6+ , Cr 7+ ); |
| ( Tc 1+ , Sr 2+ ); | (Sn 1+ , Er 2+ ); | (Pr 2+ , Xe 2+ ); |
| ( Tc 1+ , La 2+ ); | (Sn 2+ , N 2+ );  | (Pr 2+ , Pr 3+ ); |
| ( Tc 1+ , Ce 2+ ); | (Sn 2+ , Ar 2+ ); | (Pr 2+ , Nd 3+ ); |
| ( Tc 1+ , Pm 2+ ); | (Sn 2+ , V 3+ );  | (Pr 2+ , Pm 3+ ); |
| ( Tc 1+ , Sm 2+ ); | (Sn 2+ , Mo 3+ ); | (Pr 2+ , Gd 3+ ); |
| ( Tc 1+ , Eu 2+ ); | (Sn 3+ , Mn 4+ ); | (Pr 2+ , Tb 3+ ); |
| ( Tc 1+ , Tb 2+ ); | (Sn 3+ , Fe 4+ ); | (Nd 2+ , Sm 3+ ); |
| ( Tc 1+ , Dy 2+ ); | (Sn 3+ , Co 4+ ); | (Nd 2+ , Dy 3+ ); |
| ( Ru 1+ , Ca 2+ ); | (Sb 2+ , Ti 3+ ); | (Nd 2+ , Ho 3+ ); |
| ( Ru 1+ , Eu 2+ ); | (Sb 2+ , Sb 3+ ); | (Nd 2+ , Er 3+ ); |
| ( Ru 1+ , Tb 2+ ); | (Sb 2+ , Bi 3+ ); | (Nd 2+ , Lu 3+ ); |
| ( Ru 1+ , Dy 2+ ); | (Sb 3+ , C 3+ );  | (Pm 2+ , C 2+ );  |
| ( Ru 1+ , Ho 2+ ); | (Te 1+ , Sc 2+ ); | (Pm 2+ , K 2+ );  |
| ( Ru 1+ , Er 2+ ); | (Te 1+ , Y 2+ );  | (Pm 2+ , Zr 3+ ); |
| ( Rh 1+ , V 2+ );  | (Te 1+ , Gd 2+ ); | (Pm 2+ , Eu 3+ ); |
| ( Rh 1+ , Nb 2+ ); | (Te 1+ , Tm 2+ ); | (Pm 2+ , Tm 3+ ); |
| ( Rh 1+ , Sn 2+ ); | (Te 1+ , Yb 2+ ); | (Sm 2+ , Cl 2+ ); |
| ( Rh 1+ , Hf 2+ ); | (Te 1+ , Lu 2+ ); | (Sm 2+ , Sc 3+ ); |
| ( Pd 1+ , Al 2+ ); | (Te 2+ , Sc 3+ ); | (Sm 2+ , Yb 3+ ); |
| ( Pd 1+ , Si 2+ ); | (Te 2+ , Kr 2+ ); | (Eu 2+ , Nb 3+ ); |
| ( Pd 1+ , Fe 2+ ); | (Te 2+ , Yb 3+ ); | (Gd 2+ , Cl 2+ ); |
| ( Pd 1+ , Co 2+ ); | (Te 2+ , Hf 3+ ); | (Gd 2+ , Sc 3+ ); |
| ( Pd 1+ , Ru 2+ ); | (Te 3+ , Ar 3+ ); | (Gd 2+ , Eu 3+ ); |
| ( Pd 1+ , In 2+ ); | (Te 3+ , La 4+ ); | (Gd 2+ , Yb 3+ ); |
| ( Pd 1+ , Sb 2+ ); | (Te 3+ , Yb 4+ ); | (Tb 2+ , B 2+ );  |
| ( Pd 1+ , Bi 2+ ); | (Te 4+ , Bi 5+ ); | (Tb 2+ , S 2+ );  |
| ( Ag 1+ , Cu 2+ ); | (I 1+ , Al 2+ );  | (Tb 2+ , Br 2+ ); |
| ( Ag 1+ , As 2+ ); | (I 1+ , Si 2+ );  | (Tb 2+ , Xe 2+ ); |
| ( Ag 1+ , Ag 2+ ); | (I 1+ , Fe 2+ );  | (Tb 2+ , Sm 3+ ); |
| ( Ag 1+ , Cs 2+ ); | (I 1+ , Co 2+ );  | (Tb 2+ , Tb 3+ ); |
| ( Ag 1+ , Hg 2+ ); | (I 1+ , Ge 2+ );  | (Tb 2+ , Dy 3+ ); |
| ( Cd 1+ , Zn 2+ ); | (I 1+ , Ru 2+ );  | (Tb 2+ , Ho 3+ ); |
| ( Cd 1+ , Ga 2+ ); | (I 1+ , In 2+ );  | (Tb 2+ , Er 3+ ); |
| ( Cd 1+ , Cd 2+ ); | (I 1+ , Bi 2+ );  | (Dy 2+ , Cl 2+ ); |
| ( Cd 1+ , Tl 2+ ); | (Xe 1+ , Al 2+ ); | (Dy 2+ , K 2+ );  |
| ( In 1+ , Sc 2+ ); | (Xe 1+ , Co 2+ ); | (Dy 2+ , Zr 3+ ); |
| ( In 1+ , Y 2+ );  | (Xe 1+ , Ni 2+ ); | (Dy 2+ , Eu 3+ ); |

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( In 1+ , Yb 2+ ); (Xe 1+ , Rh 2+ ); (Dy 2+ , Yb 3+ );  
( In 1+ , Lu 2+ ); (Xe 1+ , Cd 2+ ); (Ho 2+ , Sc 3+ );  
( In 2+ , Sr 3+ ); (Xe 1+ , Sb 2+ ); (Ho 2+ , Yb 3+ );  
( In 2+ , Cd 3+ ); (La 2+ , Ti 3+ ); (Ho 2+ , Hf 3+ );  
( Sn 1+ , Ca 2+ ); (La 2+ , Sb 3+ ); (Er 2+ , Sc 3+ );  
( Sn 1+ , Sr 2+ ); (Ce 2+ , Ag 2+ ); (Er 2+ , Yb 3+ );  
( Sn 1+ , La 2+ ); (Ce 2+ , I 2+ ); (Er 2+ , Hf 3+ );  
( Sn 1+ , Sm 2+ ); (Ce 2+ , Cs 2+ ); (Tm 2+ , Kr 2+ );  
( Sn 1+ , Eu 2+ ); (Ce 2+ , Au 2+ ); (Tm 2+ , Nb 3+ );  
( Sn 1+ , Tb 2+ ); (Ce 2+ , Hg 2+ ); (Tm 2+ , Hf 3+ );  
( Sn 1+ , Dy 2+ ); (Pr 2+ , B 2+ ); (Yb 2+ , Ti 3+ );  
( Sn 1+ , Ho 2+ ); (Pr 2+ , Y 3+ ); (Lu 2+ , Kr 2+ );  
( Lu 2+ , Hf 3+ ); (Pb 2+ , As 3+ ); (Tl 1+ , Mg 2+ );  
( Hf 2+ , As 2+ ); (Pb 2+ , In 3+ ); (Tl 1+ , Mn 2+ );  
( Hf 2+ , Ag 2+ ); (Pb 2+ , Te 3+ ); (Tl 1+ , Mo 2+ );  
( Hf 2+ , I 2+ ); (Pb 2+ , Pb 3+ ); (Tl 1+ , Tc 2+ );  
( Hf 2+ , Cs 2+ ); (Pb 3+ , Br 4+ ); (Tl 1+ , Sn 2+ );  
( Hf 2+ , Hg 2+ ); (Bi 1+ , Ba 2+ ); (Tl 1+ , Pb 2+ );  
( Hg 1+ , Al 2+ ); (Bi 2+ , Ar 2+ ); (Pb 1+ , Sc 2+ );  
( Hg 1+ , Si 2+ ); (Bi 2+ , Mo 3+ ); (Pb 1+ , Y 2+ );  
( Hg 1+ , Co 2+ ); (Bi 3+ , Se 4+ ); (Pb 1+ , Lu 2+ ); and  
( Hg 1+ , Ni 2+ ); (Bi 3+ , Mo 4+ ); (Pb 2+ , Fe 3+ ).

*SAB*

28. A fuel cell comprising:

a vessel;  
a source of hydrogen atoms associated with said vessel;  
a cathode in said vessel; and  
a source of catalyst for forming hydrino atoms from said hydrogen atoms,  
said catalyst comprising at least one free atom selected from the group consisting  
of Be, Cu, Zn, Pd, Te and Pt.

29. A fuel cell comprising:

a vessel;  
a source of hydrogen atoms associated with said vessel;

a cathode in said vessel; and  
a source of catalyst for forming hydrino atoms from said hydrogen atoms,  
said catalyst comprising at least two species selected from the group consisting of:

( Li 0+ , Ar 5+ ); ( P 1+ , Nd 4+ ); ( Ti 2+ , As 5+ );  
( Li 0+ , Mo 6+ ); ( P 1+ , Tb 4+ ); ( Ti 2+ , Se 5+ );  
( Be 0+ , Kr 5+ ); ( P 3+ , Na 5+ ); ( V 1+ , Cd 3+ );  
( B 0+ , Sc 3+ ); ( S 0+ , Sm 3+ ); ( V 1+ , I 3+ );  
( B 0+ , Zr 3+ ); ( S 0+ , Dy 3+ ); ( V 1+ , Hg 3+ );  
( B 0+ , Yb 3+ ); ( S 0+ , Ho 3+ ); ( V 2+ , Kr 4+ );  
( C 0+ , Te 3+ ); ( S 0+ , Er 3+ ); ( V 2+ , Nb 5+ );  
( C 0+ , Tl 3+ ); ( S 0+ , Lu 3+ ); ( V 4+ , Ni 7+ );  
( N 0+ , Ag 3+ ); ( S 1+ , Nb 4+ ); ( V 4+ , Kr 8+ );  
( N 0+ , Cd 3+ ); ( S 1+ , Ho 4+ ); ( Cr 1+ , S 3+ );  
( N 0+ , Hg 3+ ); ( S 1+ , Er 4+ ); ( Cr 1+ , Ca 3+ );  
( N 1+ , Bi 5+ ); ( S 1+ , Tm 4+ ); ( Cr 3+ , Be 3+ );  
( N 2+ , Br 6+ ); ( S 2+ , Bi 5+ ); ( Cr 3+ , Zn 5+ );  
( N 2+ , Kr 6+ ); ( Cl 0+ , Ti 3+ ); ( Cr 5+ , Cu 8+ );  
( O 0+ , Cl 3+ ); ( Cl 1+ , Mo 4+ ); ( Mn 1+ , Nd 4+ );  
( O 0+ , Kr 3+ ); ( Cl 1+ , Pb 4+ ); ( Mn 1+ , Tb 4+ );  
( O 0+ , Sm 4+ ); ( Cl 3+ , Sc 5+ ); ( Mn 2+ , Ca 4+ );  
( O 0+ , Dy 4+ ); ( Cl 4+ , Br 7+ ); ( Mn 3+ , Nb 6+ );  
( O 2+ , Na 4+ ); ( Ar 0+ , Mn 3+ ); ( Mn 5+ , Ca 8+ );  
( O 2+ , Cl 6+ ); ( Ar 0+ , As 3+ ); ( Fe 1+ , Nd 4+ );  
( O 2+ , Mn 6+ ); ( Ar 0+ , Rh 3+ ); ( Fe 1+ , Pm 4+ );  
( O 3+ , Al 5+ ); ( Ar 0+ , Tl 3+ ); ( Fe 1+ , Tb 4+ );  
( F 0+ , Bi 4+ ); ( Ar 1+ , Mn 4+ ); ( Fe 3+ , Ne 4+ );  
( F 1+ , Mn 5+ ); ( Ar 1+ , In 4+ ); ( Fe 5+ , Mo 8+ );  
( F 3+ , Mg 5+ ); ( Ar 5+ , Mg 5+ ); ( Co 1+ , Pm 4+ );  
( F 4+ , Ti 8+ ); ( K 0+ , Al 3+ ); ( Co 2+ , C 4+ );  
( Ne 1+ , Ge 5+ ); ( K 0+ , Cr 3+ ); ( Co 3+ , Mg 4+ );  
( Ne 4+ , Al 6+ ); ( K 0+ , Pb 3+ ); ( Ni 1+ , La 4+ );  
( Na 0+ , Cr 4+ ); ( K 1+ , Sc 4+ ); ( Ni 1+ , Yb 4+ );  
( Na 0+ , Ge 4+ ); ( K 2+ , Cl 5+ ); ( Ni 1+ , Lu 4+ );  
( Na 1+ , Sc 5+ ); ( Ca 0+ , Eu 3+ ); ( Ni 2+ , K 4+ );  
( Na 1+ , Bi 6+ ); ( Ca 0+ , Dy 3+ ); ( Ni 5+ , Fe 8+ );  
( Na 3+ , Ne 6+ ); ( Ca 0+ , Ho 3+ ); ( Cu 0+ , Ce 3+ );  
( Na 4+ , Ne 7+ ); ( Ca 0+ , Er 3+ ); ( Cu 0+ , Pr 3+ );  
( Mg 0+ , Kr 3+ ); ( Ca 1+ , Mg 3+ ); ( Cu 1+ , Ar 3+ );  
( Mg 2+ , Al 5+ ); ( Ca 1+ , Fe 4+ ); ( Cu 1+ , Ti 4+ );  
( Mg 3+ , Na 6+ ); ( Ca 1+ , Co 4+ ); ( Cu 1+ , Te 4+ );  
( Al 1+ , Zr 5+ ); ( Ca 3+ , Co 6+ ); ( Cu 2+ , Sn 5+ );  
( Al 3+ , Mg 6+ ); ( Ca 3+ , Y 6+ ); ( Zn 0+ , Y 3+ );  
( Al 3+ , Cr 8+ ); ( Sc 1+ , C 3+ ); ( Zn 0+ , Pm 3+ );  
( Si 1+ , Zn 3+ ); ( Sc 1+ , Te 4+ ); ( Zn 0+ , Gd 3+ );  
( Si 1+ , Ce 4+ ); ( Ti 1+ , Mn 3+ ); ( Zn 0+ , Tb 3+ );  
( Si 2+ , Na 4+ ); ( Ti 1+ , Ga 3+ ); ( Zn 1+ , Mo 4+ );  
( Si 2+ , Cl 6+ ); ( Ti 1+ , As 3+ ); ( Zn 1+ , Pb 4+ );  
( Si 3+ , Be 4+ ); ( Ti 1+ , Rh 3+ ); ( Zn 2+ , N 4+ );

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( Si 5+ , N 6+ ); ( Ti 1+ , Ti 3+ ); ( Zn 2+ , Kr 5+ );  
 ( Zn 3+ , N 5+ ); ( Y 5+ , Co 7+ ); ( Ce 1+ , Ho 3+ );  
 ( Zn 5+ , Co 8+ ); ( Zr 1+ , Zr 3+ ); ( Ce 1+ , Er 3+ );  
 ( Ga 1+ , Bi 4+ ); ( Zr 2+ , Sc 4+ ); ( Ce 1+ , Lu 3+ );  
 ( Ge 1+ , S 3+ ); ( Zr 2+ , Sr 4+ ); ( Pr 1+ , Sc 3+ );  
 ( Ge 1+ , Ce 4+ ); ( Nb 1+ , Mo 3+ ); ( Pr 1+ , Zr 3+ );  
 ( As 1+ , Ca 3+ ); ( Nb 1+ , Sb 3+ ); ( Pr 1+ , Yb 3+ );  
 ( As 1+ , Br 3+ ); ( Nb 1+ , Bi 3+ ); ( Nd 1+ , Nb 3+ );  
 ( As 2+ , F 3+ ); ( Nb 2+ , Sn 4+ ); ( Nd 1+ , Hf 3+ );  
 ( As 2+ , Kr 4+ ); ( Nb 2+ , Sb 4+ ); ( Pm 1+ , Nb 3+ );  
 ( As 2+ , Nb 5+ ); ( Nb 3+ , Co 5+ ); ( Sm 1+ , Ti 3+ );  
 ( Se 1+ , Zn 3+ ); ( Nb 3+ , Rb 5+ ); ( Eu 1+ , V 3+ );  
 ( Se 1+ , Ce 4+ ); ( Nb 4+ , Zn 6+ ); ( Eu 1+ , Mo 3+ );  
 ( Se 2+ , Kr 4+ ); ( Mo 1+ , Se 3+ ); ( Eu 1+ , Sb 3+ );  
 ( Se 2+ , Nb 5+ ); ( Mo 1+ , I 3+ ); ( Gd 1+ , Bi 3+ );  
 ( Se 3+ , Ni 5+ ); ( Mo 4+ , Fe 6+ ); ( Tb 1+ , Hf 3+ );  
 ( Se 4+ , Nb 7+ ); ( Mo 5+ , Rb 8+ ); ( Dy 1+ , Ti 3+ );  
 ( Br 0+ , Eu 3+ ); ( Ag 0+ , La 3+ ); ( Ho 1+ , Bi 3+ );  
 ( Br 0+ , Tm 3+ ); ( Ag 0+ , Ce 3+ ); ( Er 1+ , Bi 3+ );  
 ( Br 1+ , Nb 4+ ); ( Cd 0+ , La 3+ ); ( Tm 1+ , V 3+ );  
 ( Br 1+ , Gd 4+ ); ( In 1+ , Nd 4+ ); ( Tm 1+ , Mo 3+ );  
 ( Br 1+ , Ho 4+ ); ( In 1+ , Tb 4+ ); ( Tm 1+ , Sb 3+ );  
 ( Br 1+ , Er 4+ ); ( Sn 1+ , Si 3+ ); ( Yb 1+ , Al 3+ );  
 ( Br 2+ , F 3+ ); ( Sn 1+ , Co 3+ ); ( Yb 1+ , Ru 3+ );  
 ( Br 2+ , Ga 4+ ); ( Sn 1+ , Ge 3+ ); ( Yb 1+ , In 3+ );  
 ( Br 3+ , O 4+ ); ( Sn 2+ , F 3+ ); ( Yb 1+ , Sn 3+ );  
 ( Br 3+ , Al 4+ ); ( Sn 2+ , Ga 4+ ); ( Lu 1+ , Tc 3+ );  
 ( Br 4+ , N 5+ ); ( Sb 1+ , Si 3+ ); ( Lu 1+ , Ru 3+ );  
 ( Kr 0+ , Ti 3+ ); ( Sb 1+ , Co 3+ ); ( Lu 1+ , In 3+ );  
 ( Kr 1+ , Sn 4+ ); ( Sb 1+ , Ge 3+ ); ( Lu 1+ , Sn 3+ );  
 ( Kr 1+ , Sb 4+ ); ( Sb 2+ , As 4+ ); ( Hf 1+ , Sc 3+ );  
 ( Kr 2+ , Ne 3+ ); ( Te 1+ , Mn 3+ ); ( Hf 1+ , Yb 3+ );  
 ( Kr 2+ , Bi 5+ ); ( Te 1+ , As 3+ ); ( Hg 0+ , La 3+ );  
 ( Kr 3+ , O 4+ ); ( Te 1+ , Rh 3+ ); ( Pb 1+ , Ni 3+ );  
 ( Kr 3+ , Al 4+ ); ( Te 1+ , Te 3+ ); ( Pb 1+ , Se 3+ );  
 ( Kr 4+ , Ar 6+ ); ( Te 1+ , Tl 3+ ); ( Pb 2+ , F 3+ );  
 ( Rb 0+ , Sc 3+ ); ( Te 2+ , Cr 4+ ); ( Pb 2+ , Ga 4+ );  
 ( Rb 0+ , Zr 3+ ); ( Te 2+ , Ge 4+ ); ( Bi 1+ , P 3+ );  
 ( Rb 0+ , Yb 3+ ); ( Te 2+ , As 4+ ); ( Bi 1+ , Sr 3+ );  
 ( Rb 1+ , N 3+ ); ( Te 3+ , Zr 5+ ); ( La 1+ , Ru 3+ );  
 ( Sr 1+ , C 3+ ); ( Te 4+ , Ni 6+ ); ( La 1+ , In 3+ );  
 ( Sr 1+ , Ar 3+ ); ( Te 4+ , Cu 6+ ); ( La 1+ , Sn 3+ );  
 ( Sr 1+ , Ti 4+ ); ( Xe 0+ , Pr 3+ ); ( Ce 1+ , Sm 3+ ); and  
 ( Sr 1+ , Te 4+ ); ( Xe 0+ , Nd 3+ ); ( Ce 1+ , Dy 3+ ).

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30. A method of generating electricity in a fuel cell comprising a vessel having a first compartment containing a cathode, a second compartment containing an anode

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and a reductant, and a salt bridge between the first and second compartments, the method comprising:

supplying hydrino atoms to said first compartment;

reducing said hydrino atoms by supplying said hydrino atoms with electrons from said cathode to form increased binding energy hydride ions and producing a current between said cathode and anode.

- 29  
31. A method according to claim 30, further comprising the step of forming said hydrino atoms from hydrogen atoms by use of a catalyst.
- 30  
32. A method according to claim 31, wherein said catalyst comprises a salt of rubidium.
- 31  
33. A method according to claim 32, wherein said salt of rubidium is selected from the group consisting of RbOH, Rb<sub>2</sub>SO<sub>4</sub>, Rb<sub>2</sub>CO<sub>3</sub>, and Rb<sub>3</sub>PO<sub>4</sub>.
- 32  
34. A method according to claim 31, wherein said catalyst comprises a salt of potassium.
- 33  
35. A method according to claim 34, wherein said salt of potassium is selected from the group consisting of KOH, K<sub>2</sub>SO<sub>4</sub>, K<sub>2</sub>CO<sub>3</sub> and K<sub>3</sub>PO<sub>4</sub>.
- 34  
36. A method according to claim 31, wherein said catalyst comprising a salt of titanium.
- 35  
37. A method according to claim 36, wherein said salt of titanium is selected from the group consisting of TiF<sub>2</sub>, TiCl<sub>2</sub>, TiBr<sub>2</sub>, TiI<sub>2</sub> and TiS.
- 36  
38. A method according to claim 31, wherein said catalyst comprising at least one selected from the group consisting of (Al<sup>2+</sup>), (Ar<sup>+</sup>), (Ti<sup>2+</sup>), (As<sup>2+</sup>), (Rb<sup>+</sup>), (Mo<sup>2+</sup>), (Ru<sup>2+</sup>), (In<sup>2+</sup>), and (Te<sup>2+</sup>).

| 25

*37* 39. A method according to claim *31*, wherein said catalyst being capable of providing a net enthalpy of reaction in the range of 26.8 to 28.5 eV.

*38* 40. A method according to claim *31*, wherein said catalyst comprising at least one pair of ions selected from the group consisting of: (Sn<sup>4+</sup>, Si<sup>4+</sup>), (Pr<sup>3+</sup>, Ca<sup>2+</sup>), (Sr<sup>2+</sup>, Cr<sup>2+</sup>), (Cr<sup>3+</sup>, Tb<sup>3+</sup>), (Sb<sup>3+</sup>, Co<sup>2+</sup>), (Bi<sup>3+</sup>, Ni<sup>2+</sup>), (Pd<sup>2+</sup>, In<sup>+</sup>), (La<sup>3+</sup>, Dy<sup>3+</sup>), (La<sup>3+</sup>, Ho<sup>3+</sup>), (K<sup>+</sup>, K<sup>+</sup>), (V<sup>3+</sup>, Pd<sup>2+</sup>), (Lu<sup>3+</sup>, Zn<sup>2+</sup>), (As<sup>3+</sup>, Ho<sup>3+</sup>), (Mo<sup>5+</sup>, Sn<sup>4+</sup>), (Sb<sup>3+</sup>, Cd<sup>2+</sup>), (Ag<sup>2+</sup>, Ag<sup>+</sup>), (La<sup>3+</sup>, Er<sup>3+</sup>), (V<sup>4+</sup>, B<sup>3+</sup>), (Fe<sup>3+</sup>, Ti<sup>3+</sup>), (Co<sup>2+</sup>, Ti<sup>+</sup>), (Bi<sup>3+</sup>, Zn<sup>2+</sup>), (As<sup>3+</sup>, Dy<sup>3+</sup>), (Ho<sup>3+</sup>, Mg<sup>2+</sup>), (K<sup>+</sup>, Rb<sup>+</sup>), (Cr<sup>3+</sup>, Pr<sup>3+</sup>), (Sr<sup>2+</sup>, Fe<sup>2+</sup>), (Ni<sup>2+</sup>, Cu<sup>+</sup>), (Li<sup>+</sup>, Pb<sup>2+</sup>), (Sr<sup>2+</sup>, Mo<sup>2+</sup>), (Y<sup>3+</sup>, Zr<sup>4+</sup>), (Cd<sup>2+</sup>, Ba<sup>2+</sup>), (Ho<sup>3+</sup>, Pb<sup>2+</sup>), (Eu<sup>3+</sup>, Mg<sup>2+</sup>), (Er<sup>3+</sup>, Mg<sup>2+</sup>), (Bi<sup>4+</sup>, Al<sup>3+</sup>), (Ca<sup>2+</sup>, Sm<sup>3+</sup>), (V<sup>3+</sup>, La<sup>3+</sup>), (Gd<sup>3+</sup>, Cr<sup>2+</sup>), (Mn<sup>2+</sup>, Ti<sup>+</sup>), (Yb<sup>3+</sup>, Fe<sup>2+</sup>), (Ni<sup>2+</sup>, Ag<sup>+</sup>), (Zn<sup>2+</sup>, Yb<sup>2+</sup>), (Se<sup>4+</sup>, Sn<sup>4+</sup>), (Sb<sup>3+</sup>, Bi<sup>2+</sup>), and (Eu<sup>3+</sup>, Pb<sup>2+</sup>).

*39* 41. A method according to claim *31*, wherein said catalyst comprising oxygen in combination with at least one atom selected from the group consisting of Cu, As, Pd, Te, Cs and Pt.

*40* 42. A method according to claim *31*, wherein said catalyst comprising at least one pair selected from the group consisting of: (B, Li<sup>+</sup>), (S, Li<sup>+</sup>), (Br, Li<sup>+</sup>), (Pm<sup>+</sup>, Li<sup>+</sup>), (Sm<sup>+</sup>, Li<sup>+</sup>), (Tb<sup>+</sup>, Li<sup>+</sup>), (Dy<sup>+</sup>, Li<sup>+</sup>), (Sb<sup>+</sup>, H<sup>+</sup>) and (Bi<sup>+</sup>, H<sup>+</sup>).

*41* 43. A method according to claim *31*, wherein said catalyst comprising at least one pair selected from the group consisting of:

|                    |                  |                   |
|--------------------|------------------|-------------------|
| ( He 0+ , Co 3+ ); | (O 1+ , Nd 4+ ); | (Al 2+ , Cl 5+ ); |
| ( He 0+ , Ga 3+ ); | (O 1+ , Tb 4+ ); | (Al 4+ , Mn 8+ ); |
| ( Li 0+ , Ni 3+ ); | (O 2+ , Ne 3+ ); | (Si 1+ , Mg 2+ ); |
| ( Li 0+ , Xe 3+ ); | (O 3+ , Sb 6+ ); | (Si 1+ , V 2+ );  |
| ( Li 0+ , Hg 3+ ); | (O 4+ , Fe 7+ ); | (Si 1+ , Tc 2+ ); |
| ( Li 1+ , Na 4+ ); | (F 0+ , Al 2+ ); | (Si 1+ , Sn 2+ ); |
| ( Li 1+ , Y 6+ );  | (F 0+ , Si 2+ ); | (Si 1+ , Hf 2+ ); |
| ( Be 1+ , Bi 6+ ); | (F 0+ , Fe 2+ ); | (Si 1+ , Pb 2+ ); |
| ( Be 2+ , Al 6+ ); | (F 0+ , Co 2+ ); | (Si 2+ , Co 3+ ); |

|                    |                   |                   |
|--------------------|-------------------|-------------------|
| ( B 1+ , C 2+ );   | (F 0+ , Ru 2+ );  | (Si 2+ , Ga 3+ ); |
| ( B 1+ , K 2+ );   | (F 0+ , In 2+ );  | (Si 2+ , Ge 3+ ); |
| ( B 1+ , Ho 3+ );  | (F 0+ , Sb 2+ );  | (Si 2+ , Tl 3+ ); |
| ( B 1+ , Er 3+ );  | (F 0+ , Bi 2+ );  | (Si 3+ , Ni 6+ ); |
| ( B 1+ , Tm 3+ );  | (F 1+ , Sb 4+ );  | (Si 3+ , Rb 7+ ); |
| ( B 1+ , Lu 3+ );  | (F 3+ , Fe 6+ );  | (Si 4+ , Al 6+ ); |
| ( C 1+ , N 2+ );   | (Ne 0+ , Sm 3+ ); | (P 1+ , Mg 2+ );  |
| ( C 1+ , V 3+ );   | (Ne 0+ , Dy 3+ ); | (P 1+ , Tc 2+ );  |
| ( C 1+ , Tc 3+ );  | (Ne 0+ , Ho 3+ ); | (P 1+ , Sn 2+ );  |
| ( C 1+ , Ru 3+ );  | (Ne 0+ , Er 3+ ); | (P 1+ , Hf 2+ );  |
| ( C 1+ , Sn 3+ );  | (Ne 0+ , Lu 3+ ); | (P 1+ , Pb 2+ );  |
| ( C 2+ , Mn 4+ );  | (Ne 1+ , N 3+ );  | (P 2+ , Ni 3+ );  |
| ( C 2+ , Co 4+ );  | (Ne 1+ , K 3+ );  | (P 2+ , Cd 3+ );  |
| ( N 0+ , Sr 2+ );  | (Ne 1+ , V 4+ );  | (P 2+ , Xe 3+ );  |
| ( N 0+ , La 2+ );  | (Ne 2+ , O 4+ );  | (P 3+ , Nb 5+ );  |
| ( N 0+ , Ce 2+ );  | (Na 0+ , Al 2+ ); | (P 5+ , C 5+ );   |
| ( N 0+ , Pr 2+ );  | (Na 0+ , Si 2+ ); | (S 1+ , P 2+ );   |
| ( N 0+ , Nd 2+ );  | (Na 0+ , Fe 2+ ); | (S 1+ , Se 2+ );  |
| ( N 0+ , Pm 2+ );  | (Na 0+ , Co 2+ ); | (S 1+ , La 3+ );  |
| ( N 0+ , Sm 2+ );  | (Na 0+ , Ru 2+ ); | (S 1+ , Ce 3+ );  |
| ( N 0+ , Eu 2+ );  | (Na 0+ , In 2+ ); | (S 1+ , Au 2+ );  |
| ( N 1+ , O 2+ );   | (Na 0+ , Sb 2+ ); | (S 2+ , Sr 3+ );  |
| ( N 1+ , Si 3+ );  | (Na 0+ , Bi 2+ ); | (S 2+ , Cd 3+ );  |
| ( N 1+ , P 3+ );   | (Na 2+ , Ti 5+ ); | (S 3+ , Cu 4+ );  |
| ( N 1+ , Mn 3+ );  | (Na 2+ , Kr 6+ ); | (S 3+ , Rb 4+ );  |
| ( N 1+ , Rh 3+ );  | (Na 3+ , Y 7+ );  | (S 4+ , O 4+ );   |
| ( N 2+ , F 3+ );   | (Mg 1+ , Rb 3+ ); | (Cl 1+ , C 2+ );  |
| ( N 3+ , Br 6+ );  | (Mg 1+ , Eu 4+ ); | (Cl 1+ , K 2+ );  |
| ( O 0+ , Ti 2+ );  | (Mg 3+ , Ne 5+ ); | (Cl 1+ , Zr 3+ ); |
| ( O 0+ , V 2+ );   | (Mg 6+ , Cl 8+ ); | (Cl 1+ , Eu 3+ ); |
| ( O 0+ , Nb 2+ );  | (Al 1+ , Sc 2+ ); | (Cl 1+ , Tm 3+ ); |
| ( O 0+ , Hf 2+ );  | (Al 1+ , Zr 2+ ); | (Cl 2+ , Te 4+ ); |
| ( O 1+ , Ne 2+ );  | (Al 1+ , Lu 2+ ); | (Cl 2+ , Sm 4+ ); |
| ( O 1+ , Ca 3+ );  | (Al 2+ , S 5+ );  | (Cl 2+ , Gd 4+ ); |
| ( Cl 2+ , Ho 4+ ); | (Sc 4+ , N 5+ );  | (Mn 4+ , Ge 5+ ); |
| ( Cl 2+ , Er 4+ ); | (Ti 2+ , Ar 2+ ); | (Fe 1+ , Sc 2+ ); |
| ( Cl 3+ , Cl 4+ ); | (Ti 2+ , Mo 3+ ); | (Fe 1+ , Y 2+ );  |
| ( Cl 5+ , Ni 6+ ); | (Ti 4+ , O 5+ );  | (Fe 1+ , Yb 2+ ); |
| ( Cl 5+ , Cu 6+ ); | (Ti 4+ , Zn 6+ ); | (Fe 1+ , Lu 2+ ); |
| ( Cl 5+ , Rb 7+ ); | (Ti 4+ , As 6+ ); | (Fe 2+ , S 3+ );  |
| ( Ar 0+ , Ba 2+ ); | (V 1+ , Sr 2+ );  | (Fe 2+ , Cu 3+ ); |
| ( Ar 0+ , Ce 2+ ); | (V 1+ , La 2+ );  | (Fe 2+ , Zn 3+ ); |
| ( Ar 0+ , Pr 2+ ); | (V 1+ , Ce 2+ );  | (Fe 2+ , Br 3+ ); |
| ( Ar 0+ , Nd 2+ ); | (V 1+ , Pr 2+ );  | (Fe 2+ , Zr 4+ ); |
| ( Ar 0+ , Ra 2+ ); | (V 1+ , Nd 2+ );  | (Fe 2+ , Ce 4+ ); |
| ( Ar 1+ , Ti 3+ ); | (V 1+ , Pm 2+ );  | (Fe 5+ , Sr 7+ ); |
| ( Ar 2+ , C 3+ );  | (V 1+ , Sm 2+ );  | (Co 1+ , Mg 2+ ); |
| ( Ar 3+ , K 4+ );  | (V 1+ , Eu 2+ );  | (Co 1+ , Cr 2+ ); |
| ( Ar 3+ , Br 5+ ); | (V 2+ , O 2+ );   | (Co 1+ , Mn 2+ ); |
| ( Ar 3+ , Mo 5+ ); | (V 3+ , Mn 4+ );  | (Co 1+ , Mo 2+ ); |

|                    |                    |                    |
|--------------------|--------------------|--------------------|
| ( Ar 4+ , Y 5+ );  | ( V 3+ , Co 4+ );  | ( Co 1+ , Tc 2+ ); |
| ( K 1+ , Si 3+ );  | ( V 4+ , Ar 6+ );  | ( Co 1+ , Pb 2+ ); |
| ( K 1+ , P 3+ );   | ( V 4+ , Sc 5+ );  | ( Co 2+ , Cu 3+ ); |
| ( K 1+ , Mn 3+ );  | ( V 5+ , Mg 5+ );  | ( Co 2+ , Zn 3+ ); |
| ( K 1+ , Ge 3+ );  | ( V 6+ , Sc 8+ );  | ( Co 2+ , Br 3+ ); |
| ( K 1+ , Rh 3+ );  | ( V 6+ , Br 8+ );  | ( Co 2+ , Zr 4+ ); |
| ( K 1+ , Tl 3+ );  | ( Cr 1+ , Sc 2+ ); | ( Co 2+ , Ag 3+ ); |
| ( K 2+ , He 2+ );  | ( Cr 1+ , Ti 2+ ); | ( Co 2+ , Ce 4+ ); |
| ( K 2+ , Si 4+ );  | ( Cr 1+ , Zr 2+ ); | ( Co 2+ , Hf 4+ ); |
| ( K 2+ , As 4+ );  | ( Cr 1+ , Lu 2+ ); | ( Co 4+ , Nb 6+ ); |
| ( K 3+ , P 5+ );   | ( Cr 2+ , F 2+ );  | ( Co 5+ , Sc 6+ ); |
| ( K 3+ , Zr 5+ );  | ( Cr 2+ , Na 2+ ); | ( Ni 1+ , Co 2+ ); |
| ( K 4+ , Rb 6+ );  | ( Cr 2+ , Se 3+ ); | ( Ni 1+ , Ni 2+ ); |
| ( K 5+ , Mg 4+ );  | ( Cr 2+ , Pd 3+ ); | ( Ni 1+ , Rh 2+ ); |
| ( K 5+ , Kr 7+ );  | ( Cr 2+ , I 3+ );  | ( Ni 1+ , Cd 2+ ); |
| ( K 6+ , Y 8+ );   | ( Cr 2+ , Hg 3+ ); | ( Ni 1+ , Sb 2+ ); |
| ( Ca 1+ , C 2+ );  | ( Cr 3+ , O 3+ );  | ( Ni 2+ , Ne 2+ ); |
| ( Ca 1+ , Sm 3+ ); | ( Cr 3+ , Ni 4+ ); | ( Ni 2+ , Ca 3+ ); |
| ( Ca 1+ , Dy 3+ ); | ( Cr 4+ , O 4+ );  | ( Ni 2+ , Nd 4+ ); |
| ( Ca 1+ , Ho 3+ ); | ( Cr 5+ , Ne 5+ ); | ( Ni 2+ , Tb 4+ ); |
| ( Ca 1+ , Er 3+ ); | ( Cr 5+ , Fe 7+ ); | ( Ni 4+ , Rb 6+ ); |
| ( Ca 1+ , Tm 3+ ); | ( Mn 1+ , V 2+ );  | ( Ni 6+ , Ar 8+ ); |
| ( Ca 1+ , Lu 3+ ); | ( Mn 1+ , Nb 2+ ); | ( Cu 1+ , Ag 2+ ); |
| ( Ca 2+ , O 3+ );  | ( Mn 1+ , Sn 2+ ); | ( Cu 1+ , I 2+ );  |
| ( Ca 2+ , Ni 4+ ); | ( Mn 1+ , Hf 2+ ); | ( Cu 1+ , Cs 2+ ); |
| ( Ca 3+ , Mn 5+ ); | ( Mn 2+ , Cu 3+ ); | ( Cu 1+ , Au 2+ ); |
| ( Ca 3+ , Rb 5+ ); | ( Mn 2+ , Zn 3+ ); | ( Cu 1+ , Hg 2+ ); |
| ( Ca 4+ , Cl 6+ ); | ( Mn 2+ , Br 3+ ); | ( Cu 2+ , Sm 4+ ); |
| ( Ca 4+ , Ar 6+ ); | ( Mn 2+ , Zr 4+ ); | ( Cu 2+ , Gd 4+ ); |
| ( Ca 4+ , Sc 5+ ); | ( Mn 2+ , Ce 4+ ); | ( Cu 2+ , Dy 4+ ); |
| ( Ca 5+ , Y 7+ );  | ( Mn 2+ , Hf 4+ ); | ( Cu 3+ , K 4+ );  |
| ( Sc 2+ , Ti 4+ ); | ( Mn 3+ , Mg 3+ ); | ( Cu 3+ , Br 5+ ); |
| ( Sc 2+ , Bi 4+ ); | ( Mn 3+ , Te 5+ ); | ( Cu 3+ , Mo 5+ ); |
| ( Cu 4+ , Rb 6+ ); | ( Se 1+ , Fe 2+ ); | ( Sr 1+ , Ga 2+ ); |
| ( Cu 5+ , Mn 7+ ); | ( Se 1+ , Co 2+ ); | ( Sr 1+ , Te 2+ ); |
| ( Zn 1+ , P 2+ );  | ( Se 1+ , Ge 2+ ); | ( Sr 1+ , Pt 2+ ); |
| ( Zn 1+ , I 2+ );  | ( Se 1+ , Ru 2+ ); | ( Sr 1+ , Tl 2+ ); |
| ( Zn 1+ , La 3+ ); | ( Se 1+ , In 2+ ); | ( Sr 2+ , C 3+ );  |
| ( Zn 1+ , Au 2+ ); | ( Se 1+ , Bi 2+ ); | ( Sr 2+ , Mo 4+ ); |
| ( Zn 1+ , Hg 2+ ); | ( Se 2+ , Te 3+ ); | ( Sr 3+ , Ar 4+ ); |
| ( Zn 2+ , Ti 4+ ); | ( Se 3+ , Br 4+ ); | ( Sr 3+ , Sr 4+ ); |
| ( Zn 2+ , Sn 4+ ); | ( Se 5+ , Y 7+ );  | ( Sr 3+ , Sb 5+ ); |
| ( Zn 2+ , Bi 4+ ); | ( Br 1+ , P 2+ );  | ( Sr 3+ , Bi 5+ ); |
| ( Zn 3+ , As 5+ ); | ( Br 1+ , I 2+ );  | ( Sr 4+ , Ar 5+ ); |
| ( Zn 4+ , Sr 6+ ); | ( Br 1+ , La 3+ ); | ( Sr 4+ , Cu 5+ ); |
| ( Zn 5+ , Mn 7+ ); | ( Br 1+ , Au 2+ ); | ( Y 2+ , Sr 3+ );  |
| ( Zn 6+ , Mo 8+ ); | ( Br 3+ , He 2+ ); | ( Y 2+ , Cd 3+ );  |
| ( Ga 1+ , Cr 2+ ); | ( Br 3+ , Si 4+ ); | ( Y 3+ , Se 5+ );  |
| ( Ga 1+ , Mn 2+ ); | ( Br 3+ , Ge 4+ ); | ( Y 3+ , Pb 5+ );  |
| ( Ga 1+ , Fe 2+ ); | ( Br 4+ , S 5+ );  | ( Y 4+ , Ti 5+ );  |

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|                    |                   |                   |
|--------------------|-------------------|-------------------|
| ( Ga 1+ , Ge 2+ ); | (Br 4+ , Cl 5+ ); | (Y 4+ , Zn 5+ );  |
| ( Ga 1+ , Mo 2+ ); | (Br 5+ , Sb 6+ ); | (Y 5+ , Co 6+ );  |
| ( Ga 1+ , Ru 2+ ); | (Br 6+ , Ar 8+ ); | (Y 6+ , K 7+ );   |
| ( Ga 1+ , Bi 2+ ); | (Kr 1+ , B 2+ );  | (Zr 2+ , P 2+ );  |
| ( Ga 2+ , Rb 3+ ); | (Kr 1+ , S 2+ );  | (Zr 2+ , Ag 2+ ); |
| ( Ga 2+ , Eu 4+ ); | (Kr 1+ , Br 2+ ); | (Zr 2+ , I 2+ );  |
| ( Ga 2+ , Tm 4+ ); | (Kr 1+ , Xe 2+ ); | (Zr 2+ , Cs 2+ ); |
| ( Ge 1+ , Mg 2+ ); | (Kr 1+ , Nd 3+ ); | (Zr 2+ , La 3+ ); |
| ( Ge 1+ , Mn 2+ ); | (Kr 1+ , Pm 3+ ); | (Zr 2+ , Au 2+ ); |
| ( Ge 1+ , Tc 2+ ); | (Kr 1+ , Tb 3+ ); | (Zr 2+ , Hg 2+ ); |
| ( Ge 1+ , Sn 2+ ); | (Kr 2+ , Kr 3+ ); | (Nb 2+ , C 2+ );  |
| ( Ge 1+ , Pb 2+ ); | (Kr 2+ , Tb 4+ ); | (Nb 2+ , K 2+ );  |
| ( Ge 2+ , F 2+ );  | (Kr 3+ , O 3+ );  | (Nb 2+ , Zr 3+ ); |
| ( Ge 2+ , Na 2+ ); | (Kr 3+ , Ni 4+ ); | (Nb 2+ , Eu 3+ ); |
| ( Ge 2+ , Se 3+ ); | (Kr 3+ , Kr 4+ ); | (Nb 2+ , Tm 3+ ); |
| ( Ge 2+ , Pd 3+ ); | (Kr 3+ , Nb 5+ ); | (Nb 2+ , Lu 3+ ); |
| ( Ge 2+ , I 3+ );  | (Kr 4+ , Zr 5+ ); | (Nb 3+ , Kr 3+ ); |
| ( Ge 3+ , V 5+ );  | (Kr 5+ , Sr 6+ ); | (Nb 3+ , Pr 4+ ); |
| ( Ge 3+ , Se 5+ ); | (Kr 6+ , Y 7+ );  | (Nb 3+ , Tb 4+ ); |
| ( Ge 3+ , Pb 5+ ); | (Rb 1+ , Nb 3+ ); | (Nb 4+ , N 4+ );  |
| ( As 1+ , Sc 2+ ); | (Rb 2+ , Te 4+ ); | (Mo 1+ , Ba 2+ ); |
| ( As 1+ , Y 2+ );  | (Rb 2+ , Sm 4+ ); | (Mo 1+ , Pr 2+ ); |
| ( As 1+ , Zr 2+ ); | (Rb 2+ , Gd 4+ ); | (Mo 1+ , Nd 2+ ); |
| ( As 1+ , Lu 2+ ); | (Rb 2+ , Dy 4+ ); | (Mo 1+ , Ra 2+ ); |
| ( As 2+ , Co 3+ ); | (Rb 2+ , Ho 4+ ); | (Mo 2+ , Ru 3+ ); |
| ( As 2+ , Ga 3+ ); | (Rb 2+ , Er 4+ ); | (Mo 2+ , Sn 3+ ); |
| ( As 2+ , Ge 3+ ); | (Rb 3+ , Mg 3+ ); | (Mo 3+ , Cr 4+ ); |
| ( As 2+ , Tl 3+ ); | (Rb 3+ , Te 5+ ); | (Mo 3+ , Ge 4+ ); |
| ( As 3+ , Fe 4+ ); | (Rb 5+ , Rb 6+ ); | (Mo 4+ , Bi 5+ ); |
| ( As 4+ , Sb 6+ ); | (Rb 6+ , Te 7+ ); | (Mo 5+ , Mn 6+ ); |
| ( Se 1+ , Al 2+ ); | (Sr 1+ , Be 2+ ); | (Mo 6+ , O 6+ );  |
| ( Se 1+ , Si 2+ ); | (Sr 1+ , Zn 2+ ); | (Mo 6+ , Cr 7+ ); |
| ( Tc 1+ , Sr 2+ ); | (Sn 1+ , Er 2+ ); | (Pr 2+ , Xe 2+ ); |
| ( Tc 1+ , La 2+ ); | (Sn 2+ , N 2+ );  | (Pr 2+ , Pr 3+ ); |
| ( Tc 1+ , Ce 2+ ); | (Sn 2+ , Ar 2+ ); | (Pr 2+ , Nd 3+ ); |
| ( Tc 1+ , Pm 2+ ); | (Sn 2+ , V 3+ );  | (Pr 2+ , Pm 3+ ); |
| ( Tc 1+ , Sm 2+ ); | (Sn 2+ , Mo 3+ ); | (Pr 2+ , Gd 3+ ); |
| ( Tc 1+ , Eu 2+ ); | (Sn 3+ , Mn 4+ ); | (Pr 2+ , Tb 3+ ); |
| ( Tc 1+ , Tb 2+ ); | (Sn 3+ , Fe 4+ ); | (Nd 2+ , Sm 3+ ); |
| ( Tc 1+ , Dy 2+ ); | (Sn 3+ , Co 4+ ); | (Nd 2+ , Dy 3+ ); |
| ( Ru 1+ , Ca 2+ ); | (Sb 2+ , Ti 3+ ); | (Nd 2+ , Ho 3+ ); |
| ( Ru 1+ , Eu 2+ ); | (Sb 2+ , Sb 3+ ); | (Nd 2+ , Er 3+ ); |
| ( Ru 1+ , Tb 2+ ); | (Sb 2+ , Bi 3+ ); | (Nd 2+ , Lu 3+ ); |
| ( Ru 1+ , Dy 2+ ); | (Sb 3+ , C 3+ );  | (Pm 2+ , C 2+ );  |
| ( Ru 1+ , Ho 2+ ); | (Te 1+ , Sc 2+ ); | (Pm 2+ , K 2+ );  |
| ( Ru 1+ , Er 2+ ); | (Te 1+ , Y 2+ );  | (Pm 2+ , Zr 3+ ); |
| ( Rh 1+ , V 2+ );  | (Te 1+ , Gd 2+ ); | (Pm 2+ , Eu 3+ ); |
| ( Rh 1+ , Nb 2+ ); | (Te 1+ , Tm 2+ ); | (Pm 2+ , Tm 3+ ); |
| ( Rh 1+ , Sn 2+ ); | (Te 1+ , Yb 2+ ); | (Sm 2+ , Cl 2+ ); |
| ( Rh 1+ , Hf 2+ ); | (Te 1+ , Lu 2+ ); | (Sm 2+ , Sc 3+ ); |

( Pd 1+ , Al 2+ ); (Te 2+ , Sc 3+ ); (Sm 2+ , Yb 3+ );  
 ( Pd 1+ , Si 2+ ); (Te 2+ , Kr 2+ ); (Eu 2+ , Nb 3+ );  
 ( Pd 1+ , Fe 2+ ); (Te 2+ , Yb 3+ ); (Gd 2+ , Cl 2+ );  
 ( Pd 1+ , Co 2+ ); (Te 2+ , Hf 3+ ); (Gd 2+ , Sc 3+ );  
 ( Pd 1+ , Ru 2+ ); (Te 3+ , Ar 3+ ); (Gd 2+ , Eu 3+ );  
 ( Pd 1+ , In 2+ ); (Te 3+ , La 4+ ); (Gd 2+ , Yb 3+ );  
 ( Pd 1+ , Sb 2+ ); (Te 3+ , Yb 4+ ); (Tb 2+ , B 2+ );  
 ( Pd 1+ , Bi 2+ ); (Te 4+ , Bi 5+ ); (Tb 2+ , S 2+ );  
 ( Ag 1+ , Cu 2+ ); (I 1+ , Al 2+ ); (Tb 2+ , Br 2+ );  
 ( Ag 1+ , As 2+ ); (I 1+ , Si 2+ ); (Tb 2+ , Xe 2+ );  
 ( Ag 1+ , Ag 2+ ); (I 1+ , Fe 2+ ); (Tb 2+ , Sm 3+ );  
 ( Ag 1+ , Cs 2+ ); (I 1+ , Co 2+ ); (Tb 2+ , Tb 3+ );  
 ( Ag 1+ , Hg 2+ ); (I 1+ , Ge 2+ ); (Tb 2+ , Dy 3+ );  
 ( Cd 1+ , Zn 2+ ); (I 1+ , Ru 2+ ); (Tb 2+ , Ho 3+ );  
 ( Cd 1+ , Ga 2+ ); (I 1+ , In 2+ ); (Tb 2+ , Er 3+ );  
 ( Cd 1+ , Cd 2+ ); (I 1+ , Bi 2+ ); (Dy 2+ , Cl 2+ );  
 ( Cd 1+ , Tl 2+ ); (Xe 1+ , Al 2+ ); (Dy 2+ , K 2+ );  
 ( In 1+ , Sc 2+ ); (Xe 1+ , Co 2+ ); (Dy 2+ , Zr 3+ );  
 ( In 1+ , Y 2+ ); (Xe 1+ , Ni 2+ ); (Dy 2+ , Eu 3+ );  
 ( In 1+ , Yb 2+ ); (Xe 1+ , Rh 2+ ); (Dy 2+ , Yb 3+ );  
 ( In 1+ , Lu 2+ ); (Xe 1+ , Cd 2+ ); (Ho 2+ , Sc 3+ );  
 ( In 2+ , Sr 3+ ); (Xe 1+ , Sb 2+ ); (Ho 2+ , Yb 3+ );  
 ( In 2+ , Cd 3+ ); (La 2+ , Ti 3+ ); (Ho 2+ , Hf 3+ );  
 ( Sn 1+ , Ca 2+ ); (La 2+ , Sb 3+ ); (Er 2+ , Sc 3+ );  
 ( Sn 1+ , Sr 2+ ); (Ce 2+ , Ag 2+ ); (Er 2+ , Yb 3+ );  
 ( Sn 1+ , La 2+ ); (Ce 2+ , I 2+ ); (Er 2+ , Hf 3+ );  
 ( Sn 1+ , Sm 2+ ); (Ce 2+ , Cs 2+ ); (Tm 2+ , Kr 2+ );  
 ( Sn 1+ , Eu 2+ ); (Ce 2+ , Au 2+ ); (Tm 2+ , Nb 3+ );  
 ( Sn 1+ , Tb 2+ ); (Ce 2+ , Hg 2+ ); (Tm 2+ , Hf 3+ );  
 ( Sn 1+ , Dy 2+ ); (Pr 2+ , B 2+ ); (Yb 2+ , Ti 3+ );  
 ( Sn 1+ , Ho 2+ ); (Pr 2+ , Y 3+ ); (Lu 2+ , Kr 2+ );  
 ( Lu 2+ , Hf 3+ ); (Pb 2+ , As 3+ ); (Tl 1+ , Mg 2+ );  
 ( Hf 2+ , As 2+ ); (Pb 2+ , In 3+ ); (Tl 1+ , Mn 2+ );  
 ( Hf 2+ , Ag 2+ ); (Pb 2+ , Te 3+ ); (Tl 1+ , Mo 2+ );  
 ( Hf 2+ , I 2+ ); (Pb 2+ , Pb 3+ ); (Tl 1+ , Tc 2+ );  
 ( Hf 2+ , Cs 2+ ); (Pb 3+ , Br 4+ ); (Tl 1+ , Sn 2+ );  
 ( Hf 2+ , Hg 2+ ); (Bi 1+ , Ba 2+ ); (Tl 1+ , Pb 2+ );  
 ( Hg 1+ , Al 2+ ); (Bi 2+ , Ar 2+ ); (Pb 1+ , Sc 2+ );  
 ( Hg 1+ , Si 2+ ); (Bi 2+ , Mo 3+ ); (Pb 1+ , Y 2+ );  
 ( Hg 1+ , Co 2+ ); (Bi 3+ , Se 4+ ); (Pb 1+ , Lu 2+ ); and  
 ( Hg 1+ , Ni 2+ ); (Bi 3+ , Mo 4+ ); (Pb 2+ , Fe 3+ ).  
 ( Hg 1+ , Rh 2+ ); (Bi 3+ , Pb 4+ );  
 ( Hg 1+ , Cd 2+ ); (Bi 4+ , P 5+ );  
 ( Hg 1+ , In 2+ ); (Bi 4+ , Kr 5+ );  
 ( Hg 1+ , Sb 2+ ); (Bi 4+ , Zr 5+ );

atom selected from the group consisting of Be, Cu, Zn, Pd, Te and Pt.

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45. A method according to claim 31, wherein said catalyst comprising at least two species selected from the group consisting of:

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( Li 0+ , Ar 5+ ); ( P 1+ , Nd 4+ ); ( Ti 2+ , As 5+ );  
( Li 0+ , Mo 6+ ); ( P 1+ , Tb 4+ ); ( Ti 2+ , Se 5+ );  
( Be 0+ , Kr 5+ ); ( P 3+ , Na 5+ ); ( V 1+ , Cd 3+ );  
( B 0+ , Sc 3+ ); ( S 0+ , Sm 3+ ); ( V 1+ , I 3+ );  
( B 0+ , Zr 3+ ); ( S 0+ , Dy 3+ ); ( V 1+ , Hg 3+ );  
( B 0+ , Yb 3+ ); ( S 0+ , Ho 3+ ); ( V 2+ , Kr 4+ );  
( C 0+ , Te 3+ ); ( S 0+ , Er 3+ ); ( V 2+ , Nb 5+ );  
( C 0+ , Tl 3+ ); ( S 0+ , Lu 3+ ); ( V 4+ , Ni 7+ );  
( N 0+ , Ag 3+ ); ( S 1+ , Nb 4+ ); ( V 4+ , Kr 8+ );  
( N 0+ , Cd 3+ ); ( S 1+ , Ho 4+ ); ( Cr 1+ , S 3+ );  
( N 0+ , Hg 3+ ); ( S 1+ , Er 4+ ); ( Cr 1+ , Ca 3+ );  
( N 1+ , Bi 5+ ); ( S 1+ , Tm 4+ ); ( Cr 3+ , Be 3+ );  
( N 2+ , Br 6+ ); ( S 2+ , Bi 5+ ); ( Cr 3+ , Zn 5+ );  
( N 2+ , Kr 6+ ); ( Cl 0+ , Ti 3+ ); ( Cr 5+ , Cu 8+ );  
( O 0+ , Cl 3+ ); ( Cl 1+ , Mo 4+ ); ( Mn 1+ , Nd 4+ );  
( O 0+ , Kr 3+ ); ( Cl 1+ , Pb 4+ ); ( Mn 1+ , Tb 4+ );  
( O 0+ , Sm 4+ ); ( Cl 3+ , Sc 5+ ); ( Mn 2+ , Ca 4+ );  
( O 0+ , Dy 4+ ); ( Cl 4+ , Br 7+ ); ( Mn 3+ , Nb 6+ );  
( O 2+ , Na 4+ ); ( Ar 0+ , Mn 3+ ); ( Mn 5+ , Ca 8+ );  
( O 2+ , Cl 6+ ); ( Ar 0+ , As 3+ ); ( Fe 1+ , Nd 4+ );  
( O 2+ , Mn 6+ ); ( Ar 0+ , Rh 3+ ); ( Fe 1+ , Pm 4+ );  
( O 3+ , Al 5+ ); ( Ar 0+ , Tl 3+ ); ( Fe 1+ , Tb 4+ );  
( F 0+ , Bi 4+ ); ( Ar 1+ , Mn 4+ ); ( Fe 3+ , Ne 4+ );  
( F 1+ , Mn 5+ ); ( Ar 1+ , In 4+ ); ( Fe 5+ , Mo 8+ );  
( F 3+ , Mg 5+ ); ( Ar 5+ , Mg 5+ ); ( Co 1+ , Pm 4+ );  
( F 4+ , Ti 8+ ); ( K 0+ , Al 3+ ); ( Co 2+ , C 4+ );  
( Ne 1+ , Ge 5+ ); ( K 0+ , Cr 3+ ); ( Co 3+ , Mg 4+ );  
( Ne 4+ , Al 6+ ); ( K 0+ , Pb 3+ ); ( Ni 1+ , La 4+ );  
( Na 0+ , Cr 4+ ); ( K 1+ , Sc 4+ ); ( Ni 1+ , Yb 4+ );  
( Na 0+ , Ge 4+ ); ( K 2+ , Cl 5+ ); ( Ni 1+ , Lu 4+ );  
( Na 1+ , Sc 5+ ); ( Ca 0+ , Eu 3+ ); ( Ni 2+ , K 4+ );  
( Na 1+ , Bi 6+ ); ( Ca 0+ , Dy 3+ ); ( Ni 5+ , Fe 8+ );  
( Na 3+ , Ne 6+ ); ( Ca 0+ , Ho 3+ ); ( Cu 0+ , Ce 3+ );  
( Na 4+ , Ne 7+ ); ( Ca 0+ , Er 3+ ); ( Cu 0+ , Pr 3+ );  
( Mg 0+ , Kr 3+ ); ( Ca 1+ , Mg 3+ ); ( Cu 1+ , Ar 3+ );  
( Mg 2+ , Al 5+ ); ( Ca 1+ , Fe 4+ ); ( Cu 1+ , Ti 4+ );  
( Mg 3+ , Na 6+ ); ( Ca 1+ , Co 4+ ); ( Cu 1+ , Te 4+ );  
( Al 1+ , Zr 5+ ); ( Ca 3+ , Co 6+ ); ( Cu 2+ , Sn 5+ );  
( Al 3+ , Mg 6+ ); ( Ca 3+ , Y 6+ ); ( Zn 0+ , Y 3+ );  
( Al 3+ , Cr 8+ ); ( Sc 1+ , C 3+ ); ( Zn 0+ , Pm 3+ );  
( Si 1+ , Zn 3+ ); ( Sc 1+ , Te 4+ ); ( Zn 0+ , Gd 3+ );  
( Si 1+ , Ce 4+ ); ( Ti 1+ , Mn 3+ ); ( Zn 0+ , Tb 3+ );  
( Si 2+ , Na 4+ ); ( Ti 1+ , Ga 3+ ); ( Zn 1+ , Mo 4+ );

( Si 2+ , Cl 6+ ); ( Ti 1+ , As 3+ ); ( Zn 1+ , Pb 4+ );  
 ( Si 3+ , Be 4+ ); ( Ti 1+ , Rh 3+ ); ( Zn 2+ , N 4+ );  
 ( Si 5+ , N 6+ ); ( Ti 1+ , Tl 3+ ); ( Zn 2+ , Kr 5+ );  
 ( Zn 3+ , N 5+ ); ( Y 5+ , Co 7+ ); ( Ce 1+ , Ho 3+ );  
 ( Zn 5+ , Co 8+ ); ( Zr 1+ , Zr 3+ ); ( Ce 1+ , Er 3+ );  
 ( Ga 1+ , Bi 4+ ); ( Zr 2+ , Sc 4+ ); ( Ce 1+ , Lu 3+ );  
 ( Ge 1+ , S 3+ ); ( Zr 2+ , Sr 4+ ); ( Pr 1+ , Sc 3+ );  
 ( Ge 1+ , Ce 4+ ); ( Nb 1+ , Mo 3+ ); ( Pr 1+ , Zr 3+ );  
 ( As 1+ , Ca 3+ ); ( Nb 1+ , Sb 3+ ); ( Pr 1+ , Yb 3+ );  
 ( As 1+ , Br 3+ ); ( Nb 1+ , Bi 3+ ); ( Nd 1+ , Nb 3+ );  
 ( As 2+ , F 3+ ); ( Nb 2+ , Sn 4+ ); ( Nd 1+ , Hf 3+ );  
 ( As 2+ , Kr 4+ ); ( Nb 2+ , Sb 4+ ); ( Pm 1+ , Nb 3+ );  
 ( As 2+ , Nb 5+ ); ( Nb 3+ , Co 5+ ); ( Sm 1+ , Ti 3+ );  
 ( Se 1+ , Zn 3+ ); ( Nb 3+ , Rb 5+ ); ( Eu 1+ , V 3+ );  
 ( Se 1+ , Ce 4+ ); ( Nb 4+ , Zn 6+ ); ( Eu 1+ , Mo 3+ );  
 ( Se 2+ , Kr 4+ ); ( Mo 1+ , Se 3+ ); ( Eu 1+ , Sb 3+ );  
 ( Se 2+ , Nb 5+ ); ( Mo 1+ , I 3+ ); ( Gd 1+ , Bi 3+ );  
 ( Se 3+ , Ni 5+ ); ( Mo 4+ , Fe 6+ ); ( Tb 1+ , Hf 3+ );  
 ( Se 4+ , Nb 7+ ); ( Mo 5+ , Rb 8+ ); ( Dy 1+ , Ti 3+ );  
 ( Br 0+ , Eu 3+ ); ( Ag 0+ , La 3+ ); ( Ho 1+ , Bi 3+ );  
 ( Br 0+ , Tm 3+ ); ( Ag 0+ , Ce 3+ ); ( Er 1+ , Bi 3+ );  
 ( Br 1+ , Nb 4+ ); ( Cd 0+ , La 3+ ); ( Tm 1+ , V 3+ );  
 ( Br 1+ , Gd 4+ ); ( In 1+ , Nd 4+ ); ( Tm 1+ , Mo 3+ );  
 ( Br 1+ , Ho 4+ ); ( In 1+ , Tb 4+ ); ( Tm 1+ , Sb 3+ );  
 ( Br 1+ , Er 4+ ); ( Sn 1+ , Si 3+ ); ( Yb 1+ , Al 3+ );  
 ( Br 2+ , F 3+ ); ( Sn 1+ , Co 3+ ); ( Yb 1+ , Ru 3+ );  
 ( Br 2+ , Ga 4+ ); ( Sn 1+ , Ge 3+ ); ( Yb 1+ , In 3+ );  
 ( Br 3+ , O 4+ ); ( Sn 2+ , F 3+ ); ( Yb 1+ , Sn 3+ );  
 ( Br 3+ , Al 4+ ); ( Sn 2+ , Ga 4+ ); ( Lu 1+ , Tc 3+ );  
 ( Br 4+ , N 5+ ); ( Sb 1+ , Si 3+ ); ( Lu 1+ , Ru 3+ );  
 ( Kr 0+ , Ti 3+ ); ( Sb 1+ , Co 3+ ); ( Lu 1+ , In 3+ );  
 ( Kr 1+ , Sn 4+ ); ( Sb 1+ , Ge 3+ ); ( Lu 1+ , Sn 3+ );  
 ( Kr 1+ , Sb 4+ ); ( Sb 2+ , As 4+ ); ( Hf 1+ , Sc 3+ );  
 ( Kr 2+ , Ne 3+ ); ( Te 1+ , Mn 3+ ); ( Hf 1+ , Yb 3+ );  
 ( Kr 2+ , Bi 5+ ); ( Te 1+ , As 3+ ); ( Hg 0+ , La 3+ );  
 ( Kr 3+ , O 4+ ); ( Te 1+ , Rh 3+ ); ( Pb 1+ , Ni 3+ );  
 ( Kr 3+ , Al 4+ ); ( Te 1+ , Te 3+ ); ( Pb 1+ , Se 3+ );  
 ( Kr 4+ , Ar 6+ ); ( Te 1+ , Tl 3+ ); ( Pb 2+ , F 3+ );  
 ( Rb 0+ , Sc 3+ ); ( Te 2+ , Cr 4+ ); ( Pb 2+ , Ga 4+ );  
 ( Rb 0+ , Zr 3+ ); ( Te 2+ , Ge 4+ ); ( Bi 1+ , P 3+ );  
 ( Rb 0+ , Yb 3+ ); ( Te 2+ , As 4+ ); ( Bi 1+ , Sr 3+ );  
 ( Rb 1+ , N 3+ ); ( Te 3+ , Zr 5+ ); ( La 1+ , Ru 3+ );  
 ( Sr 1+ , C 3+ ); ( Te 4+ , Ni 6+ ); ( La 1+ , In 3+ );  
 ( Sr 1+ , Ar 3+ ); ( Te 4+ , Cu 6+ ); ( La 1+ , Sn 3+ );  
 ( Sr 1+ , Ti 4+ ); ( Xe 0+ , Pr 3+ ); ( Ce 1+ , Sm 3+ ); and  
 ( Sr 1+ , Te 4+ ); ( Xe 0+ , Nd 3+ ); ( Ce 1+ , Dy 3+ ).

formed having a binding energy greater than the binding energy of the corresponding ordinary hydride ion for p = 2 up to 23 in which the binding energy is represented by

$$\text{Binding Energy} = \frac{\hbar^2 \sqrt{s(s+1)}}{8\mu_e a_0^2 \left[ \frac{1 + \sqrt{s(s+1)}}{p} \right]^2} - \frac{\pi \mu_0 e^2 \hbar^2}{m_e^2 a_0^3} \left( 1 + \frac{2^2}{\left[ \frac{1 + \sqrt{s(s+1)}}{p} \right]^3} \right)$$

T1330X  
where p is an integer greater than 1, s =  $\frac{1}{2}$ ,  $\hbar$  is Plank's constant bar,  $\mu_0$  is the permeability of vacuum,  $m_e$  is the mass of the electron,  $\mu_e$  is the reduced electron mass,  $a_0$  is the Bohr radius, and e is the elementary charge.

4547. A method according to claim 46, wherein p is 2 to 200.4648. A method according to claim 46, wherein a cation migrates through a salt bridge and forms a neutral compound with said hydride ion.4749. A method according to claim 30, wherein the increased binding energy hydride ion has a binding energy of about 3.0, 6.6, 11.2, 16.7, 22.8 29.3, 36.1, 42.8, 49.4, 55.5, 61.0, 65.6, 69.2, 71.53, 72.4, 71.54, 68.8, 64.0, 56.8, 47.1, 34.6, 19.2 or 0.65 eV.4850. A method according to claim 30, further comprising the step of decomposing a compound containing at least one hydrino atom to provide said hydrino atoms.4954. A method according to claim 50, wherein said compound containing a hydrino atom comprises:

(a) at least one neutral, positive or negative increased binding energy hydrogen species having a binding energy:

(i) greater than the binding energy of the corresponding ordinary

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hydrogen species, or

- (ii) greater than the binding energy of any hydrogen species for which the corresponding ordinary hydrogen species is unstable or is not observed because the ordinary hydrogen species' binding energy is less than thermal energies at ambient conditions, or is negative; and
- (b) at least one other element, wherein said increased binding energy hydrogen species is selected from the group consisting of  $H_n$ ,  $H_n^-$ , and  $H_n^+$ , where  $n$  is an integer of 1 to 8, and  $n$  is greater than 1 when H has a positive charge.

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A fuel cell comprising:  
a vessel;  
a source of at least one increased binding energy hydrogen species associated with said vessel; and  
a cathode in said vessel.

53. A fuel cell according to claim 52, wherein said increased binding energy hydrogen species is selected from the group consisting of (a) a hydride ion having a binding energy greater than the binding energy of the corresponding ordinary hydride ion for  $p = 2$  up to 23 in which the binding energy is represented by

$$\text{Binding Energy} = \frac{\hbar^2 \sqrt{s(s+1)}}{8\mu_e a_0^2 \left[ \frac{1 + \sqrt{s(s+1)}}{p} \right]^2} - \frac{\pi \mu_0 e^2 \hbar^2}{m_e^2 a_0^3} \left( 1 + \frac{2^2}{\left[ \frac{1 + \sqrt{s(s+1)}}{p} \right]^3} \right)$$

where  $p$  is an integer greater than 1,  $s = 1/2$ ,  $\hbar$  is Plank's constant bar,  $\mu_0$  is the permeability of vacuum,  $m_e$  is the mass of the electron,  $\mu_e$  is the reduced electron mass,  $a_0$  is the Bohr radius, and  $e$  is the elementary charge; (b) hydrogen atom having a binding energy greater than about 13.6 eV; (c) hydrogen molecule having

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